

SECTION 700 SANITARY SEWER FACILITIES

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SECTION 700 SANITARY SEWER FACILITIES**710.00 DESIGN CRITERIA****711.00 General**

All extensions of and/or additions to the City sewer systems will comply with the requirements of these Standards and Specifications for sewer main and service line construction. The requirements set forth in the latest edition of the Denver Wastewater Standards shall apply for information omitted in these Standards and Specifications. Any discrepancies shall be evaluated by the City.

712.00 Design Flow

The design will include consideration of providing service for the entire area tributary to the outfall point. The following wastewater flow rates, which include infiltration, shall be used:

User Type	Unit Wastewater Flow Rate
Residential	90 gallons/capita/day
Industrial	1,500 gallons/acre/day
Commercial	1,000 gallons/acre/day
Park/Recreation	50 gallons/acre/day
Elementary Schools	13 gallons/student/day
Jr. & Sr. High Schools	20 gallons/student/day

Minimum residential population density, household density and land usage shall be as noted on an approved PUD and/or Plat, or as determined by the City Planner.

Wastewater flow peaking factors shall be computed using the following equation:

$$PF = 3.8 / (ADF)^{0.17}$$

Where ADF = annual average daily flow in MGD

The peaking factor will not be less than two and one-half (2.5) or greater than five (5.0).

713.00 Hydraulic Design

Sewers ten (10) inches in diameter and smaller shall carry the peak design flow at a maximum flow depth of eighty percent (80%) of the pipe diameter. Sewer mains twelve (12) inches in diameter and larger shall carry the peak design flow at a maximum flow depth of eighty percent (80%) of the pipe diameter.

The minimum velocity at the peak design flow rate shall be two (2) feet per second. Where actual flow will be considerably below the design flow for several years, the Utilities Director

may require that the minimum velocity be attained by suitable grades at the partial peak design flow rate. Maximum allowable velocity shall not exceed ten (10) feet per second at eighty percent (80%) flow depth in the pipe.

Care shall be taken to design invert elevations at manholes in such a manner that the energy gradient is consistently falling in the direction of flow. In addition, when the velocity of an upstream sewer entering a manhole at peak flow is above critical velocity, the hydraulic gradient shall be computed to insure that a surcharge will not occur at a service connection, and that the energy gradient will remain level across the manhole.

714.00 Design Details

714.01 Sewer Mains

Sanitary sewer mains must be eight (8) inch diameter or larger. Service connections will be four (4) inch diameter or larger. Six (6) inch diameter sewer mains may be installed under special conditions where no more than four (4) residential connections are to be made if the Utilities Director approves the design. The following minimum grades (based on a Manning's formula $n = 0.015$) will apply:

Sewer Diameter (Inch)	Minimum Grade (Percent)
4	2.0 or 1/4 inch/foot
6	1.0 or 1/8 inch/foot
8	0.45
10	0.33
12	0.27
15	0.20
18	0.17
21 or larger	As approved by the City

When approved by the Utilities Director for specific areas, a Manning's $n = 0.011$ may be used and the above grades adjusted accordingly to maintain a minimum velocity of two and a half (2.5) feet per second.

In general, sewers shall be designed deep enough to drain basements and to prevent freezing. No public mains shall be less than four and half (4.5) feet deep measured from the top of pipe.

Sewer mains shall be extended at least ten (10) feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains will terminate in a manhole. Service connections will not be made at manholes but will be provided above or below the manhole, as required, unless otherwise approved by the Directors. Manholes will be stubbed out with suitable size pipe wherever future extension of the sewer is anticipated.

714.02 Manholes

Manholes shall be a minimum of forty-eight (48) inch diameter and will be provided at every change in direction, grade, or at connection with another sewer main; maximum spacing will be four hundred (400) feet for lines fifteen (15) inches diameter or smaller, or five hundred feet (500') for lines eighteen (18) inches diameter or larger. Sewer lines shall be straight and not curved between manholes, both in line and grade.

Manholes will be 48 in. diameter for lines 8 in. to 15 in. diameter, 60 in. for lines 18 in. to 21 in. diameter, and 72 in. for lines 24 in. to 30 in. diameter. Special designed vaults are required for pipes greater than 30 in. in diameter.

Outside drop manholes shall be provided for a sewer entering a manhole at an elevation twenty-four (24) inches or more above the manhole invert. Where the difference in elevation is less than twenty-four (24) inches, the invert will be filleted to prevent solids deposition.

714.03 Service Connections

Wyes or tees will be provided in the sewer main for service connections at each lot or building site as shown on the plans. Services shall not be permitted under driveway except by written permission of the Directors(s). Fittings shall be angled upwards so that the upper invert of one-eighth (1/8) bend connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. See Section 743.04, of these STANDARDS AND SPECIFICATIONS for details on service stub-ins and house service connections.

Service lines shall have a minimum of bends and drops as determined by best engineering practice and maintenance needs. When all possible, bends shall be less than 90° and be of common fitting dimensional angles.

714.04 Electronic Marker Devices

Electronic location markers shall consist of devices having a passive inductive device capable of reflecting a specifically designated impulse frequency, unique to the utility being installed. Devices shall be color-coded in accordance with the American Public Works Association's Utility Location and Coordinating Council Standards.

Marker devices shall be installed approximately 6-inches over the point to be located, and a minimum of 6-inches from any metal object. However, depth of burial shall not be less than 2 ½ feet nor more than 6-feet. Devices shall be hand backfilled to 1-foot above the device to prevent movement or damage.

Electronic Marker Devices shall be installed at the following locations:

1. At all manholes, one foot upstream of the manhole over the centerline of the main line.

2. At temporary dead ends of lines.
3. At the property line for all service laterals, including service stubs from vacuum pits
4. At the centerline of the gravity main line over all taps, risers, or wyes.
5. At all plugged tees
6. At upper bends on vacuum sewer lifts
7. At wye from branch line connection to vacuum sewer main.
8. At valves on vacuum sewer mains, one foot north or west of the valve over the line.
9. On sanitary sewer force mains
10. At valves, one foot north or west of the valve over the main line.
11. At bends, 22 ½ degrees or larger
12. At capped or plugged ends
13. At tees over the main line
14. For single services, over the main line at the service tap.

715.00 Location Details

Unless approved otherwise by the Directors, sanitary sewer mains installed in local or collector streets shall be located ten (10) feet West or South of the centerline of these streets. Service connections will not be permitted to cross an arterial street.

Where mains are installed in easements, they will ordinarily be located in the center of the easement, provided that proper maintenance manholes can be located to provide reasonable access for maintenance crews.

716.00 Relation to Water Mains

Sewer lines will be located a minimum of ten (10) feet, horizontally, from existing or proposed water mains (centerline distance). Where sewer lines cross water mains, the sewer pipe will be a minimum of eighteen (18) inches, clear, below the water main. If this clear distance is not

feasible, the crossing must be designed and constructed so as to protect the water main. The Directors must approve the crossing design.

Minimum protection shall consist of the installation of an impervious and structural sewer. Sewer pipe will be encased in reinforced concrete. The encasement shall be at least six (6) inches thick around the entire pipe and will extend a distance of ten (10) feet on either side of the water main. In all cases, suitable backfill or other structural protection must be provided to preclude settling and/or failure of the higher pipe.

717.00 Underdrain Pipe - Private

Underdrain systems shall be private and will **NOT** be maintained by the City of Brighton.

Underdrain pipe shall be installed at locations shown on the accepted plans. Underdrain pipe will be installed at those locations where excessive groundwater is encountered and the Soils Engineer recommends it. Under-drain installations will require the approval of the Directors.

Should the Developer desire to install an underdrain system to specifically collect the discharge of peripheral drain systems from individual house foundations or from sump pumps installed as a part of a peripheral drain system for house foundations, such a system shall be constructed for the exclusive advantage of the Developer and will **NOT** be maintained by the City. Any such system shall **NOT** be tied into the sanitary sewer collection system in any manner. Clean outs shall **NOT** be installed within a sanitary sewer manhole and will **NOT** be maintained by the City of Brighton. Any such system will require the approval of the Directors and must meet all applicable portions of Sections 732.02 and 733.04 of these STANDARDS AND SPECIFICATIONS.

720.00 GENERAL PROVISIONS

721.00 General

All sanitary sewer main construction within the City system and all service line construction connecting to the City's sewer mains must be completed in accordance with these STANDARDS AND SPECIFICATIONS and the accepted plans. These STANDARDS AND SPECIFICATIONS will cover new sanitary sewer service line construction and repairs to existing facilities within the City.

722.00 Permits Required

A public improvements permit shall not be issued until the Directors has accepted the sanitary sewer main plans.

723.00 Maintenance of Traffic

When street cuts are required for sanitary sewer facilities construction, the following conditions will be met so as to avoid interference with traffic:

- A. Street service cuts will be open only between 9:00 a.m. and 4:00 p.m.; and
- B. Two-way traffic will be maintained at all times around the construction area. A Traffic Control Plan (TCP) must be prepared in accordance with Section 141.08, Traffic Control, Barricades and Warning Signs, of these STANDARDS AND SPECIFICATIONS and submitted to the City for approval prior to the commencement of construction.

730.00 SANITARY SEWER MAIN CONSTRUCTION**731.00 Site Work and Earthwork****731.01 General**

Site work and earthwork shall be performed in accordance with Section 300.00, Site Work and Earthwork, of these STANDARDS AND SPECIFICATIONS.

731.02 Trenching, Backfilling and Compacting

Except where otherwise approved in writing by the Utilities Director, all major arterial or collector streets shall have pipe installed by pushing or boring.

Trenching, backfilling and compacting shall be performed in accordance with Section 350.00, Trenching, Backfilling and Compacting, of these STANDARDS AND SPECIFICATIONS.

731.03 Preservation of Monuments

Refer to Section 141.00, Protection of Public and Utility Interests, of these STANDARDS AND SPECIFICATIONS.

732.00 Materials**732.01 Sewer Pipe**

Unless otherwise approved by the Utilities Director, all sewer pipe and fittings shall be Polyvinyl Chloride (PVC) and will conform to the requirements of ASTM D3034 or F379, SDR 35, or ASTM F794, F949. All PVC pipe and fittings will be subject to inspection by the City in order to reject materials that fail to conform to the requirements of these STANDARDS AND SPECIFICATIONS.

Defects must be marked so as not to disfigure the rejected pipe. Rejected pipe shall be removed from the job site within twenty-four (24) hours. All joints will be factory prepared compression type (Elastomeric Gasket Joint), providing a watertight seal. **Solvent cement joints will not be used.**

732.02 Underdrain Pipe - Private

Underdrain systems shall be private and will **NOT** be maintained by the City of Brighton. If required as described in Section 717.00 of these STANDARDS AND SPECIFICATIONS, underdrain pipe shall be provided with joints which will prevent any shifting or misalignment of the line. Where under drains are to be constructed under sewer mains, clean-outs shall **NOT** be allowed in manholes. Suitable fittings shall be provided which will allow construction of clean-outs and bends outside of manholes.

The design engineer will determine all underdrain pipe and fittings.

732.03 Plugs

A compression stop as recommended by the pipe manufacturer shall be provided to seal the end joint of wye connections and dead-end stubs. At dead-end stub ends, away from a manhole or where wyes are installed, their locations shall be marked with a piece of two (2) inch by four (4) inch lumber.

732.04 Manholes

Manholes may be constructed of cast-in-place concrete or precast concrete. Concrete precast reinforced risers and tops must conform to ASTM Designation C-478 except that wall thickness may be either wall "A" or wall "B" as described in ASTM Designation C-76. Manholes shall conform to details shown on the Standard Drawings unless otherwise approved by the Utilities Director. Cones will be of the eccentric type.

The top of the manhole vault shall be a minimum of twelve (12) inches and a maximum of eighteen (18) inches below the finished street or ground surface elevation. Concrete extension risers or collars shall be used to bring the manhole ring and cover up to finished street or ground surface elevation.

Manhole rings and covers (all traffic covers shall be designed for H-20 traffic loading):

- A. Twenty-four (24) inch manhole rings and covers; cover weight = approximately one hundred sixty-five (165) pounds, ring weight = approximately two hundred forty (240) pounds.
- B. Twenty-four (24) inch by thirty-six (36) inch double ring and cover (36" cover with auxiliary 24" opening and cover);
36" cover weight = approximately two hundred fifty (250) pounds.

24" cover weight = approximately one hundred sixty five (165) pounds.

36" ring weight = approximately two hundred eighty (280) pounds.

- C. Manholes located outside of asphalt or concrete (such as in open space) shall be fitted with water tight lids with hinges and locking devices.

Steps shall have a minimum tensile strength of 38,000 psi, minimum yield strength of 35,000 psi, and have an elongation of not less than ten percent (10%) in two (2) inches. Without permanent deformation, steps must carry a load of one thousand (1,000) pounds when projected six (6) inches from the wall and fifteen hundred (1,500) pounds when projected four (4) inches from the wall. Steps shall be one-half (1/2) inch diameter steel-reinforcing rods completely encapsulated in Copolymer Polypropylene as manufactured by M.A. Industries, Inc. or an approved equal. Steps shall be spaced as shown on the Standard Drawings. All manhole steps shall be cast into the manhole barrel when the manhole is poured. The maximum distance from the finished ground (street) surface to the first step shall be twenty-four (24) inches.

Mortar for manholes shall be mixed in the following proportions by volume: One (1) part Portland cement; one-half (1/2) part hydrated lime; and three (3) parts sand or masonry cement. The cement, lime, and sand will be thoroughly mixed dry and only enough water added to form a mortar of proper consistency. Mortar shall be used within one (1) hour after mixing with no retempering permitted. Mortar that has taken a partial set is prohibited from use.

732.05 Manhole Base Slabs and Base Beams

Manhole base slabs may be poured in place or precast. Where possible, inverts will be the PVC pipe with the top half cut out. The slab shall be designed to uniformly support the earth load and any other reasonable loads that may occur. The minimum slab thickness shall be six (6) inches. The minimum reinforcement shall be welded wire fabric, 4x4/W4xW4. Splicing of the welded wire fabric shall be by lapping one space and securing the wire mesh together. All wire fabric shall conform to the requirements of the "Wire Reinforcement Institute, Inc."

If required, manhole base beams shall be precast, reinforced concrete. The beams shall be twelve (12) inches wide by nine (9) inches deep by eight (8) feet long.

The reinforcement shall consist of three (3) No. 5 bars longitudinally and No. 4 bars at twelve (12) inch centers transversely.

732.06 Concrete

Concrete shall conform Section 400.00, Concrete Work, of these STANDARDS AND SPECIFICATIONS. Type II cement will be used. Concrete encasement of sewer pipe shall conform to the details outlined in Section 716.00 of these STANDARDS AND SPECIFICATIONS.

732.07 Cast Iron Fittings

All cast iron manhole rings and covers, and other iron castings must be made of tough gray pig iron conforming to ASTM Designation A-48 and shall be free from cracks, holes, swells, and cold shuts, and will have a smooth workman-like finish. Fittings shall be hot dipped in asphalt varnish in such a manner as to form a firm and tenacious coating. Fittings shall conform to details shown on the Standard Drawings unless otherwise approved by the Utilities Director. Cast iron manhole rings and covers shall have a combined weight of between three hundred (300) and four hundred (400) pounds. All metal bearing surfaces between the ring and cover will be machined or fabricated to insure good seating. Manhole lids shall be provided with non-slip pattern in surface that lies flush with the elevation of the ring. Lids shall be furnished with the word "SEWER" cast on top with a confined space warning in accordance with the Standard Drawings.

732.08 Bedding Materials

Bedding materials shall be in conformance with Section 352.00, Bedding for Pipelines and Service Lines, of these STANDARDS AND SPECIFICATIONS.

The design engineer will determine the bedding materials needed for under drains, if required by the accepted plans.

732.09 Plastic Liner Pipe (Sliplining)

Sewer main sliplining shall be completed in accordance with the construction plans for the work that shall be prepared under the supervision of a Registered Professional Engineer licensed in Colorado and have been accepted by the Utilities Director. Plans shall conform to all applicable sections of these STANDARDS AND SPECIFICATIONS.

A licensed and bonded City of Brighton General Utility Contractor shall do all sewer main sliplining construction. A permit must be obtained from the Utilities Director in accordance with Section 150.00, Permits and Inspections, of these STANDARDS AND SPECIFICATIONS.

732.10 Steel Casings for Bores

Steel Casing for Bores shall be completed in accordance with the construction plans for the work that shall be prepared under the supervision of a Registered Professional Engineer licensed in Colorado and have been accepted by the Utilities Director. Plans shall conform to all applicable sections of these STANDARDS AND SPECIFICATIONS.

A licensed and bonded City of Brighton General Utility Contractor shall do all boring construction. A permit must be obtained from the Utilities Director in accordance with Section 150.00, Permits and Inspections, of these STANDARDS AND SPECIFICATIONS.

733.00 Installation**733.01 General**

Installation of PVC sewer main will conform to ASTM Designation D-3034, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". All work shall conform to the accepted plans, specifications, special provisions and the above designation, except as modified herein.

733.02 Alignment and Grade

Sanitary sewers and structures appurtenances shall be constructed accurately to the line and grade as shown on the approved plans. Construction stakes shall be placed by field parties under the direct supervision of a Registered Professional Land Surveyor licensed to practice in the State of Colorado.

The grade and alignment of the sewer will be determined and maintained by the use of a string line, parallel to the sewer supported above the ground on grade boards spaced not more than thirty (30) feet apart and rigidly anchored to and supported by substantial posts driven into the ground. The boards will be straight and true with a minimum size of the boards of two (2) inch by six (6) inch. Where possible, not less than three (3) boards will be installed and maintained in proper position at any one time as a check on the accuracy of the grade line. If the Utilities Director approves double string lines, there will be a minimum of three (3) feet six (6) inches between strings.

The grade and alignment may also be determined by use of suitable surveying instruments (checking the invert of each piece of pipe) or laser equipment, operated continuously during the construction.

"As-built" drawings, as described in Section 161.00, Construction Plan Requirements, of these STANDARDS AND SPECIFICATIONS, shall be furnished to the Utilities Director.

733.03 Protection of Existing Underground Utilities

The Contractor will be held responsible for the protection of public improvements as stated in Section 141.00, Protection of Public and Utility Interests, of these STANDARDS AND SPECIFICATIONS. It will be the Contractor's responsibility to replace all public improvements so damaged at his own expense.

733.04 Underdrain Pipe - Private

Underdrain systems shall be private and will **NOT** be maintained by the CityCity of Brighton.

Under drains shall be installed where shown on the accepted plans as required by Section 717.00 of these STANDARDS AND SPECIFICATIONS. Under drains will be day-lighted to the nearest suitable point acceptable to the Utilities Director. The trench will be excavated to the required depth and width and backfilled with underdrain bedding material.

Underdrain pipe to be determined by the design engineer.

Where underdrain pipe is required the thickness of underdrain bedding shall be increased to provide six (6) inches of bedding material under the underdrain pipe and six (6) inches of bedding material between the underdrain pipe and the sewer pipe. The underdrain pipe shall be installed to a true line and grade and held in place with underdrain bedding material as shown on the Standard Drawings. Underdrain pipe shall be continued around manholes by use of suitable bends and other fittings and have a cleanout installed outside the manhole.

733.05 Handling Pipe and Fittings

All pipe, fittings, and specials will be unloaded, stockpiled, hauled, distributed, installed and otherwise handled in a manner that will prevent breakage or other damage thereto and which will insure delivery and installation in a sound and acceptable condition.

733.06 Sewer Pipe Installation

Sewer lines shall be constructed continuously upgrade from an existing sanitary sewer except when otherwise approved by the Utilities Director. Special care must be taken to lay sewer pipe to exact line and grade with spigot ends pointing in the direction of flow. A continuous trough will be pared or excavated in the bedding to receive the bottom quadrant of the pipe barrel. Bell holes shall be excavated so that after placement, only the barrel of the pipe receives pressure from the trench bottom. The bedding material shall be placed in the trench bottom, to a thickness of six (6) inches prepared as described above, to provide a uniform and continuous bearing support for the pipe at every point between bell holes. Preparatory to making pipe joints, all surfaces of the joint must be clean and dry. Lubricants will be used as recommended by the pipe manufacturer. The pipe shall be set in position and checked for line and grade using care to keep the joint absolutely free of dirt. When final grade is achieved, the joint shall be carefully pushed home using approved methods of leverage. Care must be taken so that the bell end of the pipe will not be deflected to the extent that the gasket is pinched or rolled. Adjustment to final line and grade will then be made. If O-ring gaskets are used, immediately after completing the joint, the seating of the gasket must be checked around the entire circumference of the pipe, by visual and finger inspection. PVC sewer pipe shall be secured in place by installation of bedding material tamped under and along it up to a level of twelve (12) inches over the top of the pipe. Bedding material will be compacted in accordance with

Section 353.00, Backfill for Pipelines and Service Lines, of these STANDARDS AND SPECIFICATIONS.

All sewers shall be kept thoroughly clean and free of gravel, dirt and debris. Whenever work ceases for any reason, the unfinished end of the pipe will be securely closed with a temporary light-fitting plug. Except in the case of rehabilitation where the pipe shall be hard tied for overnight flows.

The CityCity will be notified at least two (2) working days (forty-eight [48] hours) in advance of pipe being laid in any trench. No pipe will be covered until a representative of the Utilities Director has inspected it.

733.07 Connections to Existing Manholes

Sewer pipe connections to existing manholes, where there is no pipe stubbed out, shall be made in such a manner that the finished work will conform as nearly as practicable to the essential requirements specified for new manholes. The Contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench must be chipped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Cement grout shall be used as necessary to smoothly finish the new invert and to seal the new line so the junction is watertight. A non-shrink grout shall be used.

733.08 Construction of Manholes

Manholes must be constructed in accordance with the Standard Drawings. Concrete foundations (bases) will extend at least six (6) inches below the bottom of the pipe and will be benched up to at least two (2) inches over the top of the pipe. The concrete manhole floor between the sewer pipe and the outer portions of the bench shall be flush with the top edges at the pipe spring line and will slope upward at least two (2) inches per foot. Wherever grade and alignment permit, the sewer shall be laid continuously through manhole locations and the manhole built later.

In such cases, the foundation shall be poured, as above, and the floor of the manhole sloped upward at least one (1) inch per foot out from the spring line of the pipe. When pouring the base, care must be taken to prevent flotation of the pipe. After the manhole is built, the upper half of the pipe shall be broken out and the rough edges smoothed with cement grout.

Where it is not practicable to lay the pipe continuously through manholes due to breaks in alignment, grade, or elevation of intersecting sewers, the sewer invert will be made of concrete deposited between forms. The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches will be constructed with as large a radius of curvature as possible. Inverts will be plastered with cement mortar and left smooth and clean. Where called for on the plans, a pipe bell will be stubbed out and plugged. The bell shall be placed as close to the manhole wall as possible.

Precast manhole sections will not be placed on the foundation until after it has reached sufficient strength to provide support without damage. The top of the bench shall be thoroughly cleaned and wetted with water. While the bench is still moist, a full mortar bed at least one (1) inch in thickness or Ram-Neck sealant will be applied to the precast section bearing seat. The first precast section will be carefully lowered onto the bench so that the mortar bed will be forced out from under the section evenly on all sides. Each succeeding precast section will be jointed in a similar manner and smoothly finished, inside and out. All lifting holes and other imperfections in the interior manhole wall will be filled with cement mortar.

733.09 Plastic Liner Pipe (Sliplining)

See Section 732.09 of these STANDARDS AND SPECIFICATIONS.

733.10 Steel Casing and Carrier Pipe Installation

Pits shall be excavated such that the timber blocking can be installed to give an unyielding backing for the hydraulic boring machine or jacks and to prevent sloughing of the header face. Subgrade on which rails or guides are to be set shall be stabilized with washed rock where soft or springy ground is encountered. Excavation and casing installation shall be performed simultaneously. At no time shall the advancing edge of the casing trail the excavation by more than twelve (12) inches.

Sections of the steel casing shall be trimmed, beveled and aligned in the pit so that when welded together the thrust of the boring machine will be uniformly transmitted through the casing in a horizontal plane. Welds shall be made to provide a solid firm watertight connection without the use of butt straps.

The casing pipe shall be installed by boring or jacking upgrade from the outlet end. When the carrier pipe to be installed is for gravity flow, the horizontal and vertical alignments of the casing pipe, when in place, shall not vary from those called for on the accepted plans by more than the following:

Alignment	Entrance	Midpoint	Outlet
Horizontal	$\pm 0.02'$	$\pm 0.35'$	$\pm 0.70'$
Vertical	$\pm 0.02'$	$+0.10', -0.05'$	$+0.20', -0.10'$

When excavation exceeds the advancing edge of the casing by more than twelve (12) inches or sloughing of the hanging wall occurs such that voids are created along or above the casing, external grouting of the casing will be required. Grouting shall be accomplished by pumping at between five (5) and ten (10) psi, equal parts of Portland Cement and mortar sand mixed with sufficient water to provide a slump of less than two (2) inches through grout holes in the casing until all voids are filled. Grout holes, one (1) inch to two (2) inches in diameter, shall be provided or drilled in the casing on four (4) foot centers along the pipe arch and at eight foot (8') centers along each spring line. As grouting advances each of the completed grout holes shall be plugged to a watertight condition.

Each section of carrier pipe shall have two (2) HDPE casing spacer skids mounted as described in Section 732.10 of these STANDARDS AND SPECIFICATIONS, prior to being set in the casing. Subsequent sections shall be properly joined to each other as they are set and the assembled line gradually threaded through the casing by means of applying force at the exposed end of the carrier pipe. Care shall be exercised to provide watertight joints and to protect the ends of the pipe as they are pushed by uniformly transferring said force through the pipe in a horizontal plane. It may be necessary to vary the quadrant location and thickness to obtain a uniform grade through the carrier pipe. This is especially critical on gravity lines when the alignment and grade specified for the casing pipe approaches the maximum allowable limits specified above.

Following threading and aligning the carrier pipe, the void between the carrier and the casing shall be filled with clean sand. Sand, under pressure, shall be blown in from each end through a one (1) inch to two (2) inch diameter hose and nozzles, making sure that the center portion is filled first. Once the center portion is filled, the nozzle shall be caused to gradually recede, while continuing blowing sand and filling the void until the entire line is filled. Unless otherwise specified, backfill will be considered complete when all voids below the carrier pipe springline have been filled. The top elevation of the sand should be left one (1) to two (2) inches above said springline to allow for settlement.

733.11 Wyes and Risers for Service Connections

The Contractor shall place wyes, stubs, and risers where required by the accepted plans. Wyes will be angled upwards so that the upper invert of a one-eighth (1/8) bend connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. Riser connections will be installed where the elevation of the top of the branch is more than twelve (12) feet below finished ground. Riser connections will ordinarily reach to a grade ten (10) feet below finished ground surface. Watertight plugs will be installed in each branch pipe or stub. All applicable portions of Section 740.00 of these STANDARDS AND SPECIFICATIONS shall apply. As-built measurements will be made by the Contractor or his representative to reference the wye or riser connection to the nearest manhole before backfill. Said measurements shall be carefully and accurately made and recorded and will be shown on the "as-built" plans as required by Section 161.00, Construction Plan Requirements, of these STANDARDS AND SPECIFICATIONS.

733.12 Testing and Inspection (Construction Acceptance)

Prior to Construction Acceptance, a visual examination of the sewer system shall be done. The inspector shall visually lamp the pipeline checking for a "full moon" to determine laying alignment and to check for blockages. The inspector shall visually check each manhole's interior for flaws, cracks, holes, or other inadequacies that might affect the operation or watertight integrity of the manhole. Should any inadequacies be found, the Contractor shall make repairs deemed necessary by the Inspector.

Prior to Construction Acceptance, the Contractor, at his own expense, for all new sewer construction, will conduct tests for water tightness. Tests shall be completed under the direction of the Utilities Director. The Utilities Director may require that the first two (2) manholes, including the main between them, of all sewer projects be tested before further construction to permit initial observation of the quality of construction workmanship. The Utilities Director may require additional testing during the course of construction if infiltration appears to be excessive or the quality of workmanship is questionable.

Low pressure air testing of the sewer lines (including services) and vacuum testing of all manholes will be required by the Utilities Director. Air and vacuum testing shall be completed in accordance with ASTM C-828 and as described herein. The Contractor shall provide all equipment and personnel necessary to perform the required tests. The Utilities Director shall record times and pressure and vacuum readings during the test period. A test section shall not be any longer than the length of pipe between adjacent manholes.

The low-pressure air test for sewer lines and the vacuum test for manholes shall be done after completion of backfilling and compaction. If the Utilities Director determines that reliable and uniform results are produced by the Contractor's construction methods, the low-pressure air test may be done after initial backfill and compaction.

733.12.01 Air Testing Pipeline

The ends of the sewer pipe being tested shall be plugged and braced and the test section shall be pressurized to four (4) psi. The pressure pump shall be turned off and the air in the pipe allowed stabilizing for a minimum of two (2) minutes or until the pressure reaches three and one-half (3.5) psi. The time shall be monitored as the line either holds pressure or drops no more than one-half (.5) psi (if the ground water is higher than the top of the pipe, the test pressure will be increased to account for the high groundwater).

The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 3.0 psig (greater than the average back pressure of any ground water that may be over the pipe) shall not be less than the time shown for the given diameters in the following table:

SPECIFICATION TIME REQUIRED FOR A 0.5PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE

1 Pipe Diameter (in.)	2 Minimum Time (min: Sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specified Minimum for Length (L) Shown (min:sec)							
				100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
4	1:53	597	.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:74	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:67	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09

If ground water is known to exist, the test pressure is to be increased. An air pressure adjustment shall be added to the normal test starting pressure when ground water is present. The height of ground water in feet shall be divided by all readings. (For example, if the height of water is eleven (11) and one half (1/2) feet, then the added pressure will be 5 psig. This increases the 3.5 psig to 8.5 psig, and the 2.5 psig to 7.5 psig. The allowable drop of one pound and the timing remain the same. ***In no case however, should the starting test pressure exceed 9.0 psig.***

Sections of pipe that fail the air test shall have the defects repaired and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

733.12.02 Vacuum Testing Manholes

Manholes shall be tested before the ring and cover and grade adjustment rings have been installed. All pipes entering the manhole shall be plugged and braced and a vacuum of ten (10) inches of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops one (1) inch. The vacuum must not drop more than one (1) inch for the duration of the time indicated in the following table:

MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS									
	Diameter (in.)								
	30	33	36	42	48	54	60	66	72
Depth (ft)	Time (sec)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

Manholes that fail the vacuum test shall have the defects located and repaired and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

733.12.03 Deflection Testing Piping

All PVC sewer pipelines shall be tested for vertical deflection after placement and compaction of backfill unless the Inspector specifically expects testing. Method of testing shall be by deflectometer of the rigid GO/No-GO type device. An alternative method will be permitted only by written permission of the Inspector. Maximum allowable deflection shall be five (5) percent of the pipe diameter. Any and all pipe with vertical deflection greater than the allowable shall be excavated, removed from the pipeline, replaced, backfilled and compacted as specified and retested.

The Contractor, at the Contractor's expense, will jet-rod the sewer lines at the time of Construction Acceptance.

When required, infiltration tests shall be conducted by placing an approved, calibrated V-notch weir in the line just above the lower manhole and plugging the line just above the upper manhole. Up to an hour time lapse will be allowed for the level of water behind the weir to stabilize before it is read. Any foreign matter hanging to the weir will be dislodged before reading. Successive readings will be taken until consistent results are attained.

When required, exfiltration tests will be conducted by plugging the line just above both the upper and lower manholes and adding water to the sewer up to a level marked in the upper manhole to produce a four (4) foot head on the invert of the line at the midpoint between manholes. The water will be allowed to stand for a minimum of four (4) hours (preferably overnight) to allow absorption to take place in the walls of the manhole and pipe. Water will then be added to bring the water surface back to the mark. After a carefully timed interval, varying from fifteen (15) minutes to sixty-

(60) minutes, the drop in elevation of the water surface will be recorded and converted to an exfiltration rate, or a measured amount of water will be added to bring the water level back to the mark and this amount of water converted to an exfiltration rate.

The exfiltration rate of the upper manhole may be determined in the same manner by plugging the line in both sides of this manhole. This amount of exfiltration may be subtracted from the rate determined above for the first test required on the project in order to determine the actual exfiltration rate resulting from the pipe joint leakage. The practical upper limit of head applied to the lower part of the line being tested is twenty (20) feet. Whenever the line is so steep as to require more head than this, an exfiltration test will not be attempted. The basic exfiltration leakage allowance will be increased by ten percent (10%) for each two (2) feet that the average actual head exceeds the basic four (4) feet of head, up to a maximum of thirty percent (30%).

Whenever the rate of infiltration or exfiltration is found to exceed the prescribed amount, the Contractor shall stop all construction. The Contractor shall make appropriate repairs by methods acceptable to the Utilities Director and will continue to test the conduit until it is proven satisfactory.

THE CITYCITY WILL NOT ACCEPT ANY SANITARY SEWER LINE WHERE INFILTRATION OR EXFILTRATION TESTS SHOW LEAKAGE IN THE SEWER LINE AND MANHOLES EXCEEDING ONE HUNDRED (100) GALLONS PER INCH DIAMETER PER MILE PER DAY BETWEEN ADJACENT MANHOLES.

Construction Acceptance of the sewer line shall be based on an inspection covering all items in this specification. The inspection will be done in an appropriate manner by representatives of the Utilities Director and shall comply with the requirements of Section 154.00, Inspections, of these STANDARDS AND SPECIFICATIONS. The Contractor will remedy, at his own expense, any poor alignment or any other defects in workmanship or materials revealed by conditional inspection. Final acceptance will be based on re-inspection of the sewer after the appropriate repairs and corrections are completed.

733.13 Testing and Inspection (Final Acceptance)

Prior to final acceptance the Contractor, at the Contractor's expense, will jet-rod the sewer and have the lines inspected with TV video equipment (a copy of the video tape and written report must be supplied to the City). If, after visual inspection of the sewer main, the Utilities Director suspects that there is a problem, he may require that alignment, infiltration, exfiltration and deflection tests be completed by the Contractor at the Contractor's expense.

When required, infiltration tests will be conducted by placing an approved, calibrated V-notch weir in the line just above the lower manhole and plugging the line just above the upper manhole. Up to an hour time lapse will be allowed for the level of water behind the weir to stabilize before it is read. Any foreign matter hanging to the weir will be dislodged before reading. Successive readings will be taken until consistent results are attained.

When required, exfiltration tests will be conducted by plugging the line just above both the upper and lower manholes and adding water to the sewer up to a level marked in the upper manhole to produce a four (4) foot on the invert of the line at the midpoint between manholes. The water will be allowed to stand for a minimum of four (4) hours (preferably overnight) to allow absorption to take place in the walls of the manhole and pipe. Water will then be added to bring the water surface back to the mark. After a carefully timed interval, varying from fifteen (15) minutes to sixty- (60) minutes, the drop in elevation of the water surface will be recorded and converted to an exfiltration rate, or a measured amount of water will be added to bring the water level back to the mark and this amount of water converted to an exfiltration rate.

The exfiltration rate of the upper manhole may be determined in the same manner by plugging the line in both sides of this manhole. This amount of exfiltration may be subtracted from the rate determined above for the first test required on the project in order to determine the actual exfiltration rate resulting from the pipe joint leakage. The practical upper limit of head applied to the lower part of the line being tested is twenty (20) feet. Whenever the line is so steep as to require more head than this, an exfiltration test will not be attempted. The basic exfiltration leakage allowance will be increased by ten percent (10%) for each two (2) feet that the average actual head exceeds the basic four (4) feet of head, up to a maximum of thirty percent (30%).

THE CITYCITY WILL NOT ACCEPT ANY SANITARY SEWER LINE WHERE INFILTRATION OR EXFILTRATION TESTS SHOW LEAKAGE IN THE SEWER LINE AND MANHOLES EXCEEDING ONE HUNDRED (100) GALLONS PER INCH DIAMETER PER MILE PER DAY BETWEEN ADJACENT MANHOLES.

Final acceptance of the sewer line shall be based on an inspection covering all items in this specification. The inspection will be done in an appropriate manner by representatives of the Utilities Director and shall comply with the requirements of Section 154.00, Inspections, of these STANDARDS AND SPECIFICATIONS. The Contractor will remedy, at his own expense, any poor alignment or any other defects in workmanship or materials revealed by final inspection. Final acceptance will be based on reinspection of the sewer after the appropriate repairs and corrections are completed.

733.14 Connection to City Sewer System

Flow of any kind into the existing sewer system will not be allowed until the sewer has been satisfactorily completed and accepted for use by the Utilities Director.

740.00 SANITARY SEWER SERVICE LINE CONSTRUCTION

741.00 Trenching, Backfilling and Compacting

Trenching, backfilling and compacting shall be completed in accordance with Section 350.00, Trenching, Backfilling and Compacting, of these STANDARDS AND SPECIFICATIONS.

742.00 Materials

742.01 Polyvinyl Chloride (PVC)

Pipe and fittings shall conform to the requirements of ASTM D3034. All joints shall be factory prepared compression type (elastomeric gasket joint), providing a watertight seal. A compression stop, as recommended by the pipe joint manufacturer, will be provided to seal the end joint of dead-end stubs.

742.02 Inspection

All pipes shall be subject to inspection at the point of delivery in Brighton. The purpose of this inspection is to reject pipe that fails to conform to the requirements of these STANDARDS AND SPECIFICATIONS. Plastic joint material damaged in any way shall be cause for rejection of that joint of pipe.

743.00 Installation

743.01 General

All installation work shall conform to applicable portions of ASTM C-12 and to the pipe manufacturer's installation instructions.

743.02 Location and Alignment of Service

Sanitary sewer service lines shall be constructed on the shortest and straightest route possible. The service may be constructed with one or more horizontal one-eighth (1/8) bends between the house plumbing and the sanitary sewer main with the written approval of the Director(s). Clean-outs shall be installed in accordance with UBC, the UPC and as described herein. Unless specific approval is obtained in writing from the Director(s), all sanitary sewer service lines shall have a minimum depth of four and a half (4.5) feet.

At no time shall the service line be closer than three (3) feet to a side property line, and no service line may be constructed through or in front of an adjoining property. Sewer service lines shall be typically located a minimum of ten (10) feet to the low side of the water service, generally five (5) feet from the centerline of the lot, or as shown on the accepted plans. Generally, services shall not be located under driveways.

743.03 Crossing Sidewalk or Curb (Existing or Proposed)

An existing sanitary sewer service can be removed and replaced or bored, jacked or tunneled through the earth under the sidewalk or curb upon the Director's approval. If the service is removed and replaced all surface improvements must be removed and replaced to better than existing condition. The trench shall be backfilled in accordance with Section 353.00, Backfilling for Pipelines and Service Lines, of these STANDARDS AND SPECIFICATIONS.

If the service line is installed prior to the placement of the sidewalk or curb, the trench shall be backfilled in accordance with Section 353.00, Backfilling for Pipelines and Service Lines, of these STANDARDS AND SPECIFICATIONS.

743.04 Service Stub-ins to Property Line

All sewer service lines shall be marked on the curb with an "X" or "S" symbol where the service crosses under the curb. All service stub-ins shall be stubbed into the lots, ten (10) feet beyond the back of walk or five (5) feet past any utility easement which ever is greater. All service stub-ins shall be plugged with a compression stop. All service stub-ins shall be located with the end marked with a 2x4 painted green.

THE PROPERTY OWNER SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF THE SEWER SERVICE LINE UP TO BUT NOT INCLUDING THE MAIN, AS SET FORTH IN THE BRIGHTON MUNICIPAL CODE, SECTIONS 13-12-50 , CONNECTION TO PUBLIC SEWER, AND 13-12-80 COSTS BORNE BY OWNER; INDEMNIFICATION OF CITY

743.05 Tapping the Main

Where wyes have not been installed in the sewer main, the main will be tapped by machine drilling a hole into it sized to fit the saddle being used for the tap. The Utilities Director shall approve the drilling machine and method of drilling. A representative of the City shall inspect the main and saddle at every tap prior to backfilling. In the event that a tap is covered before it is inspected, the Contractor, at his own expense, shall uncover the tap and remove any concrete or mortar from around the fitting to allow for a visual inspection of the tap and the main. If the sewer main is cracked or broken during the process of locating and tapping, the Contractor shall, at his expense, immediately repair the broken. Sewer tapping saddle shall be an epoxy and double strapped saddle.

A manhole will be installed instead of a service tap when a six (6) inch connection is to be made to an eight (8) inch or smaller main. Service taps directly into a manhole will not be allowed without the written approval of the Utilities Director. When approved, service taps into manholes will be completed in accordance with Section 730.00 of these STANDARDS AND SPECIFICATIONS.

The only exception to the above paragraph is in the event of vitrified clay pipe (VCP). The Utilities Department reserves the right to require the need for a manhole service connection when the VCP is not able to support a properly sealed or structurally sound connection. Approval for said taps will be completed in accordance Section 730.00 of these STANDARDS AND SPECIFICATIONS.

743.06 Pipe Installation

Pipe shall be installed in accordance with the Standard Drawings. In those cases where the sewer service cannot be installed a minimum of ten (10) feet horizontally away from a water service, concrete encasement of the sewer line will be required. The pipe shall be installed in accordance with all applicable portions of Section 733.00 of these STANDARDS AND SPECIFICATIONS.

In those cases where the water and sewer service lines must cross one another, installation shall be completed in accordance with Section 716.00 of these STANDARDS AND SPECIFICATIONS.

Where sewer service lines are engineered and controlled in accordance with Section 733.02 of these STANDARDS AND SPECIFICATIONS, the minimum grades set forth in Section 714.00 of these STANDARDS AND SPECIFICATIONS shall apply.

743.07 Industrial

All buildings (warehouses, etc.) constructed as a shell, with the intention of only being used for subdivided suites for commercial purposes, shall be required to install service connections extending a minimum of six (6) feet outside of the building with a clean-out for each set of proposed bathrooms or suites. All commercial and industrial facilities must have a clean out on the outside of the building, located a minimum of three (3) feet from the building, on the service connection.

743.08 Other Requirements

Rainwater leaders, roof drains, surface drains or ground water drains shall not be connected to the sanitary sewer system. Each sanitary sewer service system shall be separate from the drainage system. Grease and sand traps will be installed where required by the provisions of the International Plumbing Code (IPC).

750.00 FLOW METERING AND SAMPLING STATION CONSTRUCTION

751.00 General

Except as otherwise specifically noted on accepted plans, or specified herein, all materials and installation for flow measurement and sampling stations will conform to all applicable portions of Section 700.00 of these STANDARDS AND SPECIFICATIONS.

752.00 Equipment Compatibility

The Contractor will, prior to procuring and installing any equipment, consult with the CityCity to insure that the equipment purchased and installed is compatible in all respects to the existing sampling and flow measurement equipment owned by the CityCity. The City is preparing for the eventuality that parts of the sanitary sewer system will one day be a part of the Denver Metro Wastewater Reclamation District. All compatibilities must not only meet current equipment but also future needs.

753.00 Sampling Station Manholes

Manholes will be constructed, complete with covers, fittings, and other appurtenances, in accordance with the Standard Drawings.

754.00 Grating

All grating and grating treads will be aluminum. Except as modified herein, grating manufacturer, fabrication, and installation will comply with the recommendations in the "Metal Bar Grating Manual" of the National Association of Architectural Metal Manufacturers. Aluminum grating will be the pressure locked type. Grating treads will be pressure locked or one piece extruded type. Bearing bars will be at least three-sixteenths (3/16) inch flat stock, or equivalent I-bars, with center to center spacing of one and three-sixteenths (3/16) inch.

Cuts in grating will be sawed or sheared. Cuts will be clean and smooth without fins, beads, or other projections. Grating will be fabricated into panels that can easily be handled by plant personnel. Panels will be within three-sixteenths (3/16) inch plus or minus of the design length, within one-eighth (1/8) inch plus or minus of the design width, and will have a maximum difference in length of opposite diagonals of one-fourth (1/4) inch. The spacing of the bearing bars will be within one thirty-second (1/32) inch of authorized spacing. Cross bars and edge bars of adjacent panels will align. After installation, there will not be more than one-fourth (1/4) inch clearance between panels. All bearing bars will be parallel. Bands and toe plates will align with one-eighth (1/8) inch tolerance, vertical and horizontal.

All grating shall lie flat with no tendency to rock when installed. Poorly fitted or damaged grating will be rejected. Steel frames cast in concrete to support grating shall be hot-dip galvanized after fabrication.

755.00 Weir Plates and Grooves

Weir plates, mounted in grooves, shall be fabricated from aluminum plate with edges accurately finished. Plates will be provided with U-shaped lifting handles. Weir plate guide grooves will be steel. Each groove opening will be at least one-quarter (1/4) inch wider than the thickness of the plate installed therein. Grooves will have all interior surfaces smooth.

Weir plate grooves shall be installed plumb and straight within a tolerance of three thirty-seconds (3/32) inch and with the opposite sides and bottom aligned in a single plane to prevent binding of the weir plate. If necessary to meet this requirement, a space will be boxed out for guides and the guides grouted in place later.

Weirs will be V-notch Weirs for flows ranging up to 0.15 MGD, and will be an eighteen (18) inch wide Cippoletti Weir with flows ranging from 0.15 to 0.5 MGD. Weir design shall be reviewed by the Utilities Director to insure adequate flow measurement. A staff gauge will be read in inches. At the base of the staff gauge, a clip to attach a bubble tube will be provided. Once in place, no flow bypass around the weir will be allowed. Weir plates and grooves will comply with the Standard Drawings.

756.00 Station Location

The location of the flow measurement and sampling station will be such that it is easily accessible at all times by City personnel. The City's Utilities Director must approve the location of the station.

757.00 Operation of Existing Facilities

The operation of the existing sanitary sewer system shall not be interrupted or injured by the sample station construction. Foreign materials must not be introduced into the sewer system at any time.

758.00 Drawings and Data

Complete data, detailed drawings, and setting or erection drawings covering all structural and miscellaneous metal items must be prepared by a Registered Professional Engineer licensed to practice in Colorado and submitted to the Utilities Director for review and acceptance prior to fabrication. The Developer shall provide the City with a set of "as built" mylars in accordance with Section 161.00, Construction Plan Requirements, of these STANDARDS AND SPECIFICATIONS.

760.00 SEWAGE LIFT STATIONS**761.00 General**

In those locations that cannot be served by gravity into the existing City system, the City may approve the construction of a sewage lift station. The sewage lift station, as determined by the Utilities Director, may be either a temporary or a permanent facility. The Developer must provide the Utilities Director with a complete set of design calculations and Mylar drawings for review and acceptance by the Utilities Director in compliance with Section 160.00, Plans and Specifications, of these STANDARDS AND SPECIFICATIONS.

The sewage lift station must satisfy all of the requirements of the Colorado Department of Public Health and the Environment (CDPHE) and of these STANDARDS AND SPECIFICATIONS. The City will require that the Developer's engineer prepare the "Application for Site Approval" for the submittal to the Colorado Department of Health and to prepare a set of "as built" drawings of the sewage lift station in accordance with Section 222.00, Acceptance Procedures, of these STANDARDS AND SPECIFICATIONS. Upon completion of the lift station, the Contractor shall also provide the City with two (2) copies of an "Operation and Maintenance Manual" for the lift station.

762.00 Design Criteria**762.01 Wet Well Construction**

Section retained for future specification. All designs shall be approved by the Utilities Director or his/her designee.

762.02 Pumps and Pump Station

Section retained for future specification. All designs shall be approved by the Utilities Director or his/her designee.

A STANDBY GENERATOR, CAPABLE OF OPERATING THE ENTIRE STATION FOR A MINIMUM OF FOUR HOURS, SHALL BE PROVIDED AND LOCATED OUTSIDE OF THE BUILDING IN AN ALL WEATHER ENCLOSURE.

762.03 Controls and Supervisory Control and Data Acquisition (SCADA)

Pump operation will feature automatic sequencing of the pump operation to balance pump wear. Pumps will be controlled by pre-determined wet well levels measured by mercury float switches.

A SCADA system will be incorporated into the system to automatically contact the City in case of an emergency. The SCADA system will be equipped with several channels so it will be capable of differentiating between a variety of emergency conditions including high and low wet well levels, pump failures and power failure.

The SCADA system shall be compatible with the City's system and will be reviewed and accepted by the City's Utilities Director prior to installation.

The controls, SCADA equipment, miscellaneous electrical equipment and automatic power switch will be installed in a control room located on the above ground floor of the pump station.

762.04 Site Improvements

A six (6) foot high chain link fence with barb less wire will be installed around the perimeter of the sewage lift station site. Upon completion of the lift station construction all disturbed areas within the site will be fertilized, seeded and mulched in accordance with Section 1030.00, Seeding Specifications, of these STANDARDS AND SPECIFICATIONS.

Depending on site location, landscaping improvements may be required by the Utilities Director.

770.00 RESTORATION AND CLEANUP

Restoration and cleanup shall be completed in accordance with Section 360.00, Restoration and Cleanup, of these STANDARDS AND SPECIFICATIONS.